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VIA ECFS

January 20, 2022

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
45 L Street, NE
Washington, DC 20554

Re: Notice of *Ex Parte* Presentation, WT Docket No. 21-282

Dear Ms. Dortch:

On January 18, 2022, representatives of Gogo Business Aviation LLC (“Gogo BA”) met with Commission staff to discuss Gogo BA’s request for a limited waiver of Section 22.867 of the Commission’s rules, which governs the effective radiated power limits for air-to-ground (“ATG”) operations in the 849-851 MHz and 894-896 MHz bands.¹ A list of meeting participants is appended as Attachment A.

During the meeting, the Gogo BA representatives noted that the National Public Safety Telecommunications Council (“NPSTC”) and Motorola Solutions, Inc. (“Motorola”) initially opposed the waiver request.² Afterward, Gogo BA met with representatives of those two organizations separately to discuss Gogo BA’s operations and why the proposed waiver would have a very limited impact on adjacent licensees.³ Most recently, both Motorola and NPSTC filed *ex parte* letters proposing conditions on the requested waiver grant.⁴

Gogo BA appreciates NPSTC and Motorola’s continued engagement on these issues. Gogo BA agrees in principle with their proposed conditions, summarized below in Table 1. Because some of those proposed conditions overlap with current FCC rules applicable to Commercial ATG operations, however, Gogo BA proposes minor modifications to NPSTC’s and Motorola’s proposed conditions to

¹ Request for Waiver of Gogo Business Aviation LLC, WT Docket No. 21-282 (filed May 26, 2021); 47 C.F.R. § 22.867.

² Comments of National Public Safety Telecommunications Council, WT Docket No. 21-282 (filed Aug. 6, 2021); Comments of Motorola Solutions, Inc., WT Docket No. 21-282 (filed Aug. 6, 2021).

³ See Letter from Michele C. Farquhar, Counsel, Gogo BA, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 21-282 (filed Oct. 12, 2021). During those meetings, Gogo BA representatives provided additional technical information in the slide deck appended to this letter as Attachment B.

⁴ Letter from Ralph A. Haller, Chairman, NPSTC, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 21-282 (filed Dec. 14, 2021) (“NPSTC Letter”); Further Comments of Motorola, WT Docket No. 21-282 (filed Dec. 15, 2021) (“Motorola Letter”).

clarify Gogo BA's obligations vis-à-vis licensees in the 851-854 MHz and 896-897.5 MHz bands consistent with current FCC Commercial ATG rules.⁵

Table 1: Waiver Grant Conditions Requested by NPSTC and Motorola

Proposed NPSTC Conditions on Gogo BA	Proposed Motorola Conditions on Gogo BA
1. attenuate emissions into the 851-854 MHz public safety band by at least 50 + 10Log(P) dB	1. attenuate emissions into the 896-897.5 MHz band by at least 43 + 10Log(P) dB;
2. incorporate some means of identification of its signal so the source of any interference can be readily determined;	2. incorporate some means of identification of its signal so the source of any interference can be readily determined;
3. maintain a 24/7 contact number public safety can use to report any instances of interference;	3. maintain a 24/7 contact number affected 900 MHz licensees can use to report any instances of interference;
4. address any reports of interference by public safety immediately;	4. address any reports of interference by 900 MHz licensees immediately;
5. mitigate reported interference by taking all steps necessary to resolve the matter to the satisfaction of the reporting public safety agency;	5. mitigate reported interference by taking all steps necessary to resolve the matter to the satisfaction of the reporting 900 MHz licensee;
6. immediately vacate operation on the channel(s) causing interference until the solution is agreed to by the public safety agency reporting the interference. ⁶	6. immediately vacate operation on the channel(s) causing interference until the solution is agreed to by the 900 MHz licensee reporting the interference. ⁷

Proposed Condition #1: Out-of-Band Emissions

Section 22.861(a) establishes an out-of-band-emissions ("OOBE") limit of 43 + 10 log(P) dB for Commercial ATG operations.⁸ NPSTC requests an OOBE limit of 50 + 10Log(P) dB for Gogo BA's transmissions into the 851-854 MHz band. Gogo BA agrees to accept and abide by this condition. Motorola proposes that the Commission adopt a waiver condition that would impose the same OOBE

⁵ For example, if (1) a rule requires a Commercial ATG operator to respond to interference complaints within 24 hours and (2) a waiver condition requires Gogo BA to respond "immediately," it is not clear whether "immediately" means 24 hours or something sooner or later than 24 hours. In an analogous situation, the FCC found it acceptable to allow 800 MHz SMR licensees to respond within 24 hours regarding any public safety harmful interference reports. *See also, e.g., Improving Spectrum Efficiency Through Flexible Channel Spacing and Bandwidth Utilization for Economic Area-based 800 MHz Specialized Mobile Radio Licensees et al.*, Report and Order, 27 FCC Rcd 6489 ¶ 18 (2012) ("EA-based 800 MHz SMR licensees are required to respond to any notification of harmful interference reported by public safety licensees to that website within 24 hours. Although the procedure in Section 90.674 is not identical to APCO's proposal, we find that it is adequate . . . [W]e decline to impose additional, largely duplicative requirements on EA-based 800 MHz SMR licensees.").

⁶ NPSTC Letter at 4.

⁷ Motorola Letter at 3-4.

⁸ 47 C.F.R. § 22.861(a).

limit already required by rule. Because that condition is duplicative of the current rule, Gogo BA proposes that the Commission adopt only the following condition proposed by NPSTC:

Gogo BA's transmissions into the 851-854 MHz band shall be attenuated by a factor of at least $50 + 10 \log (P)$ dB.

Proposed Condition #2: Signal Identification

Both NPSTC and Motorola request a condition that Gogo BA's transmissions include a signal identifier. However, demodulating relatively weak interfering emissions for the purpose of detecting and decoding the station identity would be very challenging and likely unsuccessful, whether the interference was due to out-of-band emissions or intermodulation products. Demodulating the fundamental emission will easily reveal the station identity, but this is not necessary because Gogo BA is the only licensee authorized to operate in the 849-851 MHz and 894-896 MHz bands. Because Gogo BA is the sole licensee in these bands, identifying or ruling out Gogo BA as a source of harmful interference is readily achievable by simply using a spectrum analyzer. Additionally, if interference from airborne transmitters is suspected, Gogo has the capability to quickly track down individual Gogo transmitters through data logging by time and location. For these reasons, Gogo BA proposes the following condition:

Gogo BA shall provide to licensees in the 851-854 MHz and 896-897.5 MHz bands, upon their request, instructions on how to ascertain through the use of a spectrum analyzer whether Gogo BA transmissions are the source of harmful interference.

Proposed Condition #3: 24/7 Point of Contact

Both NPSTC and Motorola request that Gogo BA "maintain a 24/7 contact number" for affected licensees to report interference events. Gogo BA agrees, already does so,⁹ and proposes that the Commission adopt the following condition:

Gogo BA shall maintain a 24/7 contact number that licensees in the 851-854 MHz and 896-897.5 MHz bands can use to report any instances of interference.

Proposed Conditions #4–6: Response to Interference Reports, Interference Mitigation, and Interference Abatement

Both NPSTC and Motorola request that Gogo BA "address" interference reports "immediately," mitigate reported interference, and "immediately vacate operation on the channel(s) causing interference until the solution is agreed to."¹⁰ The Commission has already adopted interference notification, mitigation, remediation, and abatement procedures for non-cellular Part 90 licensees operating in the 851-854 MHz band.¹¹ In brief, Gogo BA must (1) respond to interference notifications within 24 hours of receiving notice, (2) complete an interference analysis within 48 hours of notice,

⁹ Reply Comments of Gogo BA, WT Docket No. 21-282, at 9 (filed Aug. 23, 2021) ("Gogo BA provides a single point of contact who is available twenty-four hours per day, seven days per week, 365 days per year to receive and address interference complaints.").

¹⁰ See *supra* notes 6-7.

¹¹ 47 C.F.R. §§ 22.879, 90.674.

and (3) take corrective actions within 48 hours of notice.¹² The Commission also enumerated interference mitigation steps¹³ and clarified that Commercial ATG licensees must abate “unacceptable interference.”¹⁴ Given these specific, time-tested interference notification and remediation procedures, Gogo BA believes that adopting the last three conditions proposed by NPSTC would prove duplicative and create greater uncertainty both for Gogo BA and for public safety operators in the 851-854 MHz band.

These procedures for addressing interference, however, do not apply to Part 90 licensees in the 896-897.5 MHz band. Thus, to address Motorola’s last three proposed conditions, Gogo BA proposes the Commission adopt the following condition to mirror the requirements protecting public safety licensees in the 851-854 MHz band:

Gogo BA shall receive and respond to harmful interference complaints from Part 90 operators in the 896-897.5 MHz band in a manner consistent with the requirements protecting adjacent Part 90 non-cellular 800 MHz licensees in Sections 22.877 through 22.879 of the Commission’s rules.

* * *

As described above, NPSTC’s and Motorola’s concerns are addressed by their proposed conditions, as slightly modified by Gogo BA to address overlapping FCC Commercial ATG rules. Consistent with the resolution of these concerns, Gogo BA urges the Commission to adopt a limited waiver of Section 22.867 of the Commission’s rules to facilitate its transition to a more secure and higher capacity next-generation technology. Please contact me with any questions.

Respectfully submitted,

/s/ Michele C. Farquhar
Michele C. Farquhar
Tom Peters
Hogan Lovells US LLP
Counsel to Gogo Business Aviation LLC

cc: Tom Derenge
Jessica Greffenius
Roger Noel
Halie Peacher
Moslem Sawez
Attachments

¹² 47 C.F.R. § 22.879(a)(2), (b).

¹³ 47 C.F.R. § 22.879(c); see, e.g., 47 C.F.R. § 22.879(c)(1)(vii) (“[T]he means whereby interference is abated or the technical parameters that may need to be adjusted is left to the discretion of the commercial aviation air-ground system licensee, whose affirmative measures may include, but not be limited to, the following techniques . . . [s]upplying interference-resistant receivers . . .”).

¹⁴ 47 C.F.R. §§ 22.877, 22.878, 22.879, 22.970. For the avoidance of doubt, Gogo BA would discontinue transmissions when Part 90 public safety licensee determines that a continuing presence of interference constitutes a clear and imminent danger to life or property under conditions specified in Section 22.879(c)(3). 47 C.F.R. § 22.879(c)(3).

**Attachment A – Participants in January 18, 2022 Meeting between
Gogo BA and the Federal Communications Commission**

FCC Staff

Thomas Derenge
Jessica Greffenius
Roger Noel
Halie Peachner

Gogo BA Representatives

Bill Gordon
Michele C. Farquhar (of Hogan Lovells US LLP)
Tom Peters (of Hogan Lovells US LLP)
Ryan Thompson (of Hogan Lovells US LLP)

**Attachment B – Presentation on the Technical Details of
Gogo BA's 800 MHz Air-to-Ground RF Emissions**

Gogo Air to Ground Network – RF Emission

Presentation to NPTSC

Nov 18, 2021



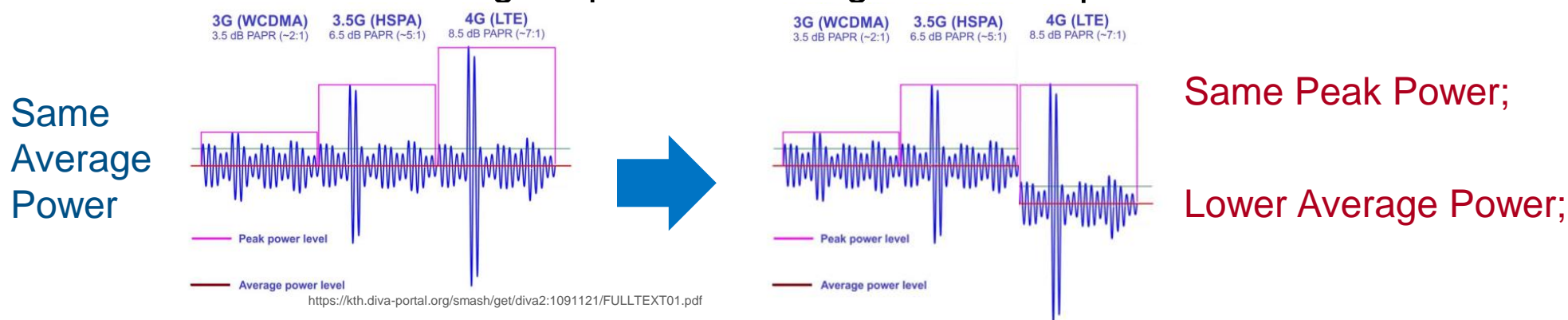
- Gogo provides broadband connectivity service for Commercial, General Aviation, and Government aircraft
- Gogo's Air to Ground (ATG) systems are installed on 6,000+ aircraft
- Gogo owns and operates a network of 256 ATG base stations in the United States and Canada, mainly in rural areas
 - Network has been in commercial operation since 2008
 - Network utilizes 3G EvDO air interface in dedicated ATG licensed 800 MHz band
- Gogo has offices in Broomfield, CO and Chicago, IL

Gogo FCC 22.867 Power Waiver Request

- Gogo is planning an upgrade to 4G due to technology obsolescence of 3G
- Existing FCC rule 22.867 specifies power measurement using a peak power detector
 - Other mobile wireless licenses use averaging power detector for power measurement

Service	General Aviation	Commercial Aviation	Cellular	PCS	WCS/AWS	PLMR
Rule	22.809	22.867	22.913	24.132	27.5	90.205
EIRP limit method	Average Power	Peak Power	Average Power	Average Power	Average Power	Average Power

- Industry standards use average power for network planning
- Canada has already approved average power detector method for ATG
- 4G air interface necessitates a higher peak to average ratio compared to 3G

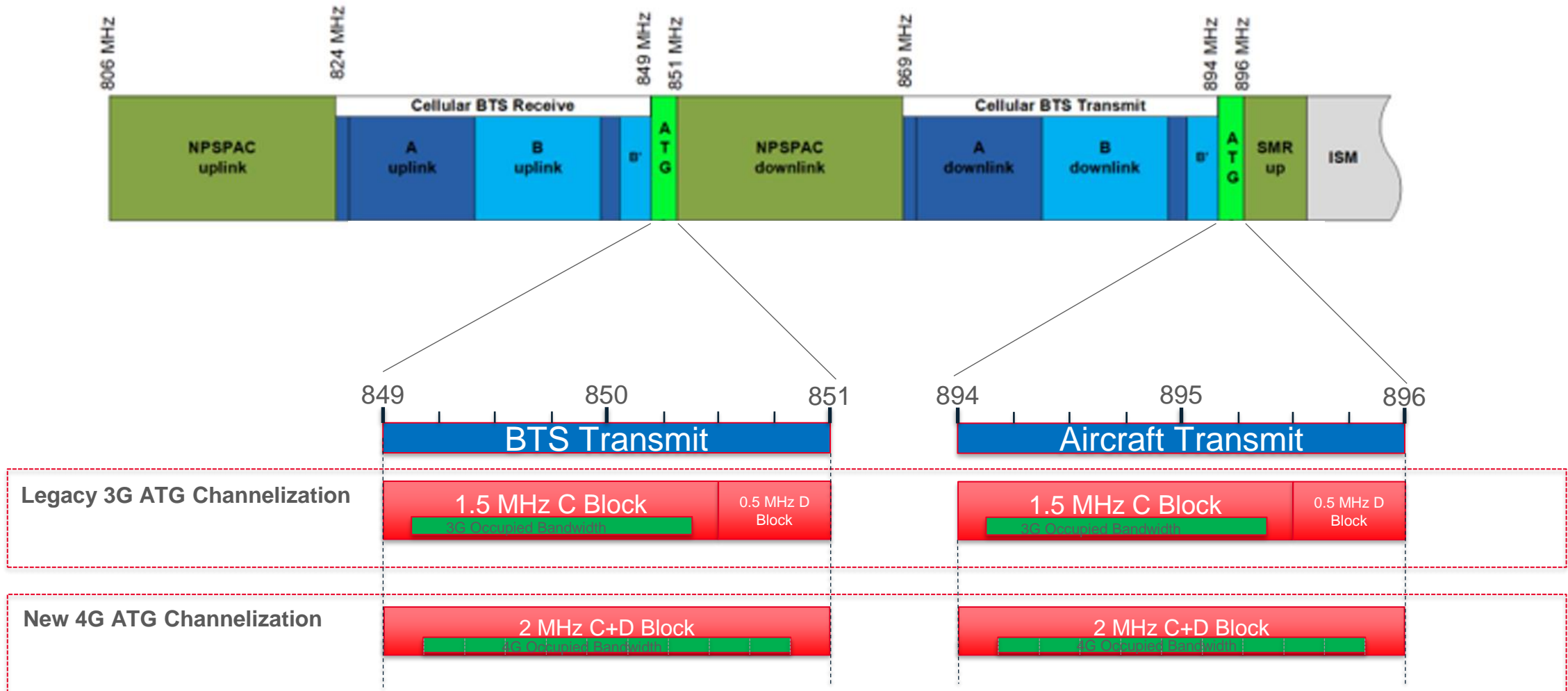


- Power measurement using peak detection would reduce the average power transmitted in the 4G system causing coverage holes and service interruptions

- Waiver is appropriate where relief through rulemaking is not feasible, such as here
 - A rulemaking would add years of delay; FCC action by the middle of 1Q2022 is needed to avoid delays in testing and deployment
 - When the FCC updated the power measurement rules for Cellular Service, this was done initially through several waiver grants
 - The FCC's goal was to bring Cellular Service's power rules in alignment with AWS and PCS, which were updated in 2008
 - Waiver here allows the FCC to efficiently harmonize the Commercial Aviation service rules with all other Part 22 services
- Experimental license for testing purpose not ideal as the 4G system cannot operate at the same time as the 3G system
 - 4G uses the same spectrum as 3G, so turning on a 4G transmitter while 3G is operational would cause service interruptions to Gogo's customers

Gogo ATG Spectrum

Gogo's ATG network operates in 2x2MHz FDD spectrum allocated for air to ground use



Gogo Commitment to Public Safety Interference Protection



- Gogo is committed to being a good spectrum neighbor and will immediately address any interference issues
 - 14 years operating current ATG network
 - Well established interference coordination and mitigation process
 - Part of publicsafety800mhzinterference.com reporting website
 - Experienced field operations engineers with tools and equipment for resolving interference issues
 - 24/7 Point of Contact: Gogo Network Operations Center (866) 943-4662
- ATG spectrum is a good buffer between Cellular Service and Public Safety
 - Limited number of transmitters
 - Good spatial isolation between ATG transmitters and adjacent receivers
 - ATG base station antennas point up while terrestrial wireless base station antenna point below horizon
 - Aircraft transmissions only above 3,000 ft. above ground level

Gogo ATG Base Station Locations

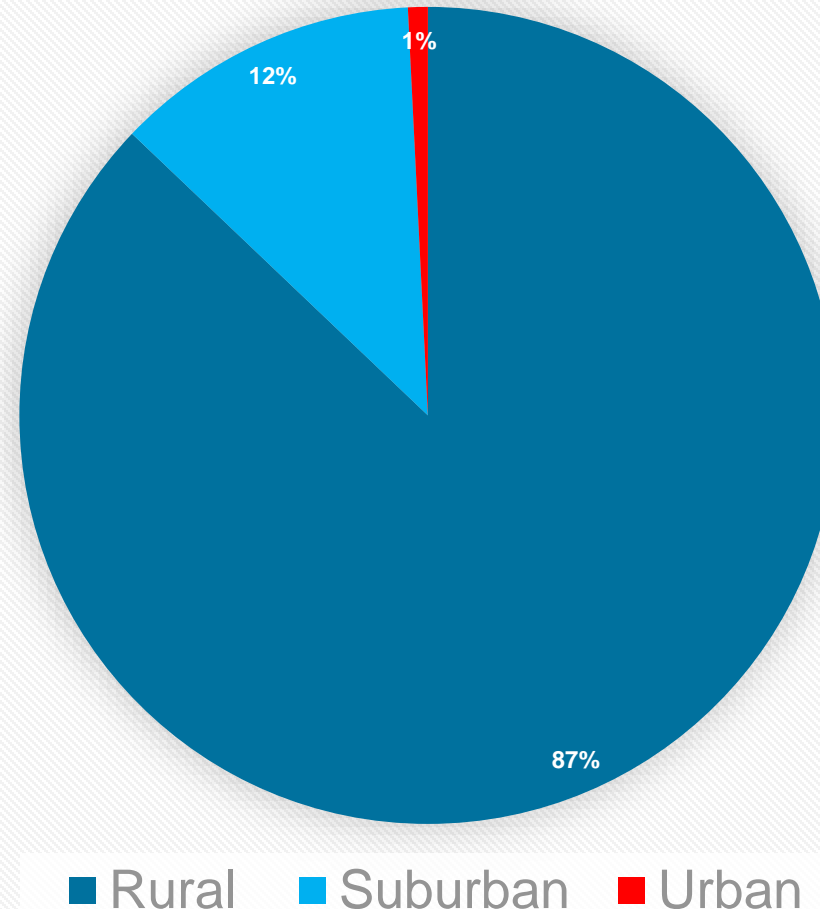
87% of Gogo's 256 base stations in the US and Canada are in Rural morphology

12% in Suburban morphology

Only 2 sites in Urban morphology
-Tysons Corner, VA
-Atlanta, GA

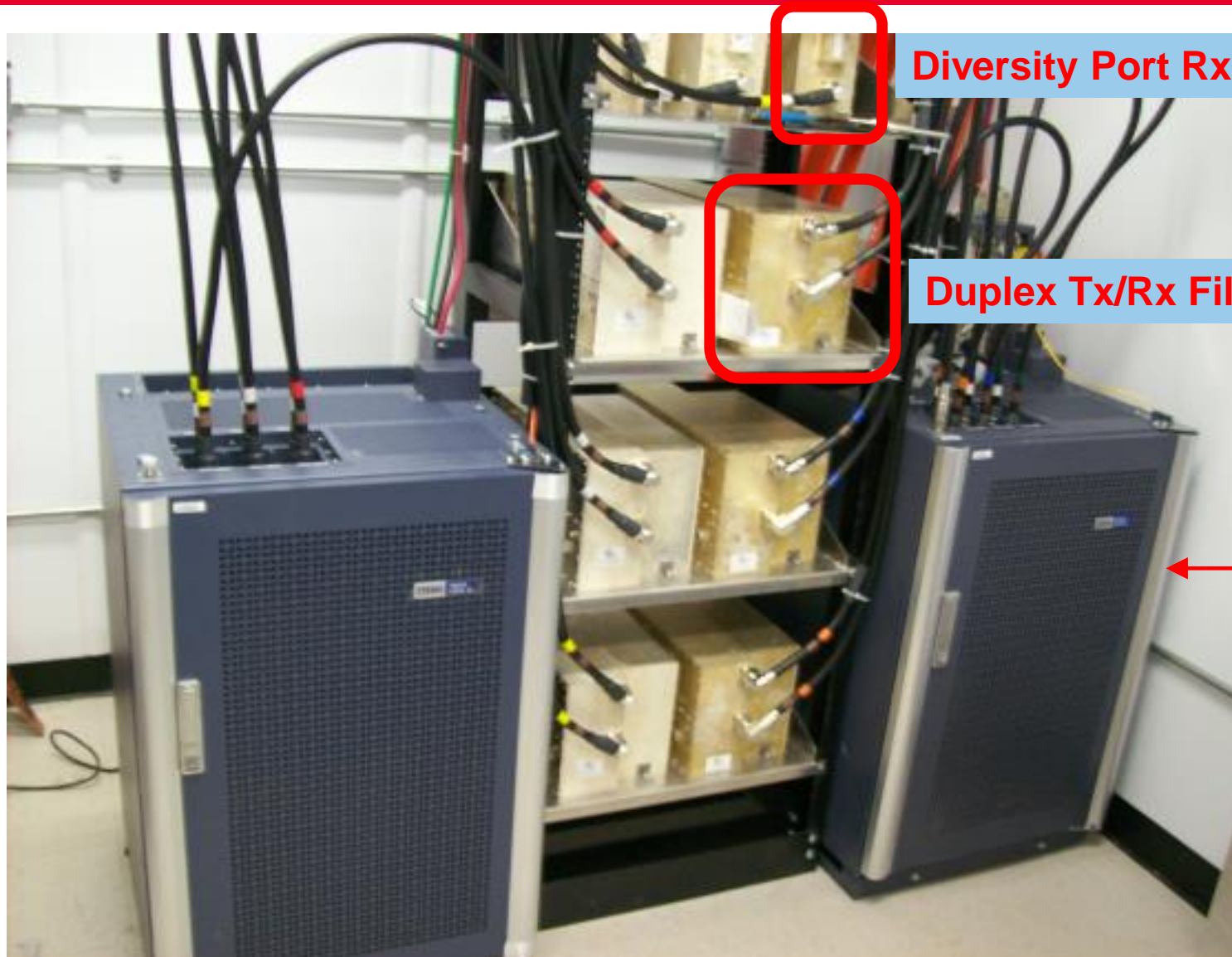
Exact base station location information available under NDA

Gogo Base Station Location Category



- Prevalent 4G base station architecture has radio transceiver at the top of the tower (remote radio head) -
 - Cheaper for suppliers to integrate radio head with antenna
 - Lower power, less cable loss, and better link margin
 - Ability to counter interference is limited by size and weight constraints on tower
- Gogo chose a traditional architecture with the radio head on the ground, along with the other base station equipment
 - Allows large cavity filters to reduce interference
 - Gogo invested in large cavity filters that go beyond FCC requirements

Gogo 3G Base Station Equipment with External Cavity Filters



Diversity Port Rx Filter

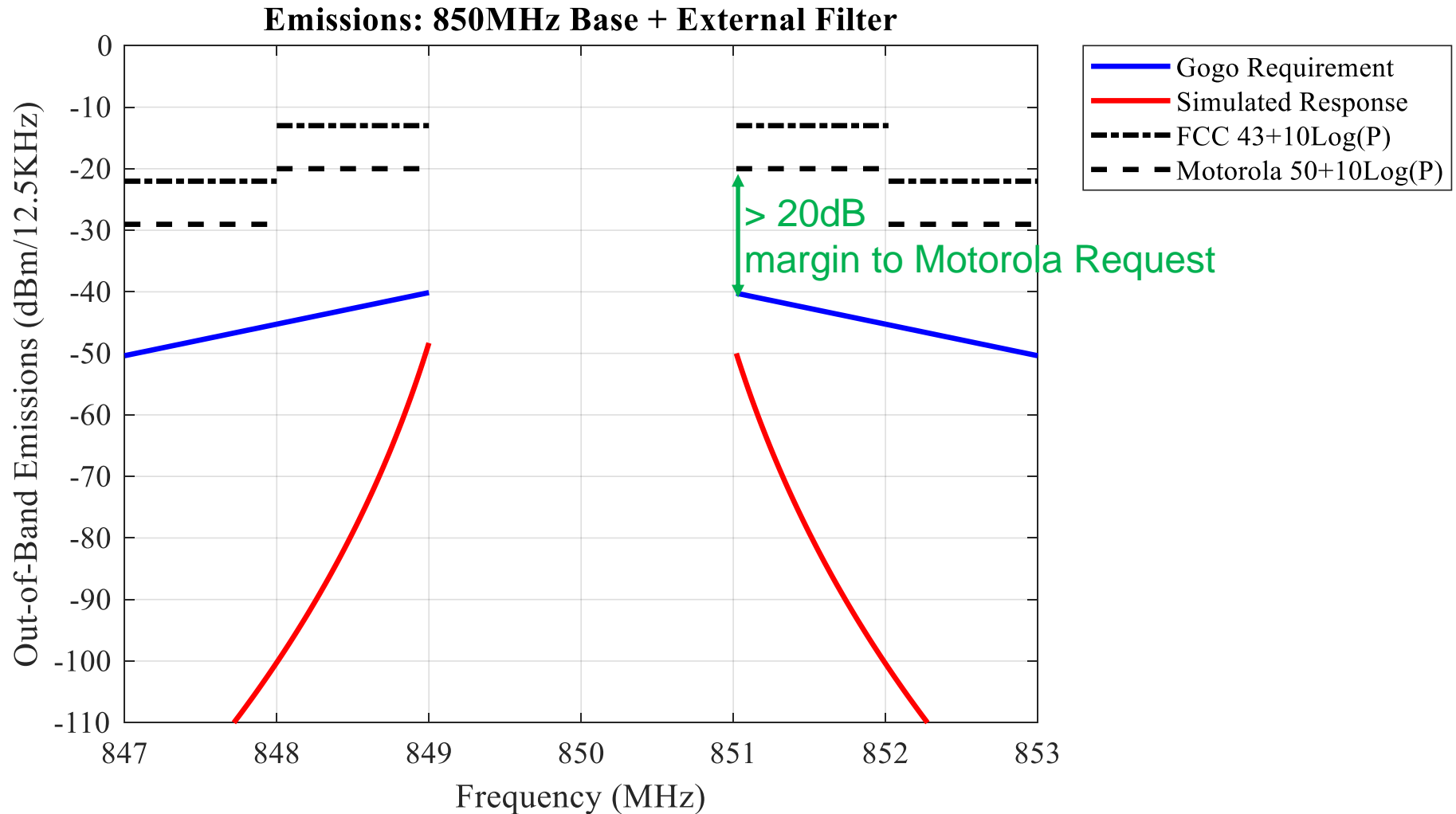
Duplex Tx/Rx Filter

**BTS: RF Front end has
internal cavity filters**

Gogo 4G base
station would have
similar external
cavity filters

4G ATG Base Station Out of Band Emissions Design Target

- Gogo is designing the 4G ATG solution with stringent out of band emission requirements that go well beyond FCC and Motorola thresholds



- Gogo is a good spectrum neighbor operating in 800 MHz licensed ATG spectrum for more than a decade
- Gogo is designing a 4G ATG solution that is unlikely to interfere with Public Safety mobiles
 - Out of band emissions well below FCC requirement and Motorola's recommended threshold
- Gogo is committed to resolving any interference that occurs to Public Safety, in the unlikely event it occurs, and has provided a 24/7 point of contact